

[Embodiment]

Now, an example of the present invention will be described with reference to drawings.

Figure 1 shows an example of a procedure of transmitting
5 a square area of 4×4 in an original image as a unit in
16 grades by means of two valued G3 facsimile device.

In Figure 1, at first, a procedure of controlling a
receiving side and a sending side is established according
to a procedure in G3 facsimile device. A call is set and
10 a line is established in phase A (steps (1), (9)). Phase
B is a sequence for confirming states of a terminal or a
transmission channel and for controlling a terminal. In
phase B, the receiving side is informed that a code indicating
gradation determined by the transmission method according
15 to the present invention is used (step (2)). When an
acknowledgement from the receiving side is obtained (step
(10)), a code indicating gradation is transmitted by message
transmission in phase C (step (3)-(7)). After the facsimile
message ends, the line is disconnected (step (8)).

20 In transmitting a facsimile message, the sending side
retrieves a square area of 4×4 pixels from the original
image (step (3)), determines the gradation in the square
area based on density of each of 16 pixels (steps (4), (5)),
encodes and transmits the gradation (step (6)) as shown in
25 Figure 2. As for an amount of information in a unit pixel
block configured with 4×4 pixels as a unit, one pixel has
either of two types of information as one pixel is white

or black. Accordingly, assuming that each pixel is independent and one pixel has information amount of one bit, this unit pixel block of 4×4 pixels includes information amount of 16 bits. Therefore, with the above-mentioned
5 dithering method, 16 grades can be represented by using pixel patterns. Then, if a single code is assigned to one of pixel patterns in the above-mentioned dithering method, 16 codes are required and four bits are enough for coding. By directly encoding gradation in this manner, the amount of code to
10 be transmitted is reduced.

On the other hand, when the receiving side recognizes that a code representing gradation is transmitted (step (10)), it reproduces a halftone image by selecting and printing out pixel patterns in the above-mentioned dithering method
15 to represent the gradation according to the gradation represented by the transmitted code the pattern (steps (11), (12)).

As there are multiple types of sets of the above-mentioned pixel patterns for digitizing a halftone
20 image according to the above-mentioned dithering method and each set gives a different quality of pseudo-halftone image, the receiving facsimile device can select the set that most faithfully reproduces the transmitted manuscript in a suitable way. As the transmitted code directly represents
25 a gradation, when the receiving facsimile device has a function of printing out in halftone, the gradation can be printed as it is.

[Advantages of the Invention]

As described above, the transmission method of pseudo-half-tone image in a facsimile device of the present invention can transmit a half-tone image by higher encoding efficiency than in conventional methods of transmitting by
5 encoding at a pixel level.

Figure 1

- #1 (SENDING SIDE)
- (1) PHASE A
SET CALL AND ESTABLISH LINE
- 5 (2) PHASE B
CONFIRM FUNCTION AND STATE OF TERMINAL
CONFIRM FUNCTION OF TRANSMISSION CHANNEL
- (3) RETRIEVE SQUARE OF 4×4 FROM ORIGINAL IMAGE
- (4) OBTAIN DENSITY OF EACH PIXEL
- 10 (5) DETERMINE GRADATION OF SQUARE
- (6) SEND CODE REPRESENTING GRADATION
- (7) MESSAGE SENT?
- (8) DISCONNECT LINE
- #2 (RECEIVING SIDE)
- 15 (9) PHASE A
ACCEPT CALL
- (10) PHASE B
DISPLAY FUNCTION OF TERMINAL AND PREPARE FOR RECEIVING
- (11) RECEIVE CODE
- 20 (12) RECOGNIZE CODE AND PRINT OUT PIXEL PATTERN OF GRADATION
- (15) MESSAGE RECEIVED?
- (14) DISCONNECT LINE

Figure 2

- 25 #1 (ORIGINAL IMAGE)
- #2 PIXEL
- #3 (4×4 SQUARE AREA)

- #4 (SET OF PIXEL PATTERNS)
- #5 (DETERMINED GRADATION)
- #6 (DIGITIZED IMAGE)

5 Figure 3

- #1 (SENDING SIDE)
 - (15) RETRIEVE SQUARE AREA OF 4×4 FROM ORIGINAL IMAGE
 - (16) OBTAIN DENSITY OF EACH PIXEL
 - (17) DETERMINE GRADATION OF SQUARE AREA
- 10 (18) REPLACE WITH PIXEL PATTERN REPRESENTING GRADATION
- (19) ENCODE AND TRANSMIT IN PIXEL LEVEL

ルで符号化して伝送する従来方法に比べ高い符号化効率で中間調画像を伝送できる。

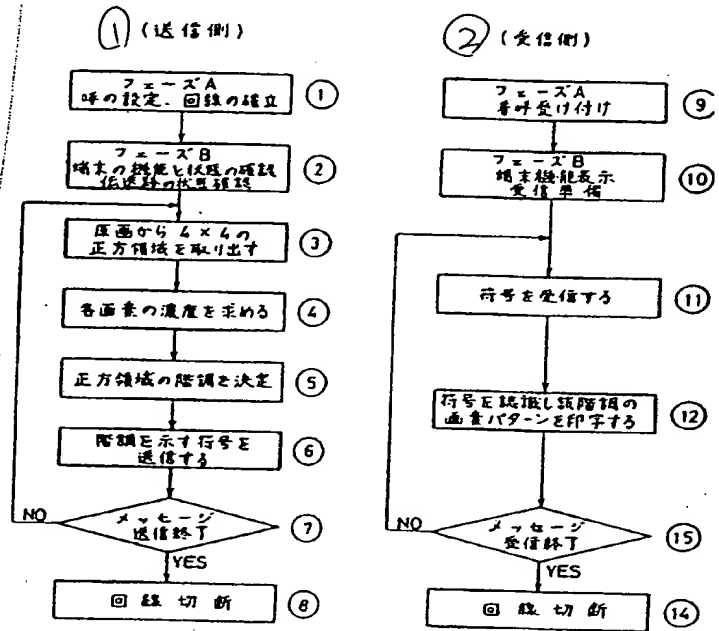
4. 図面の簡単な説明

第1図は本発明に係るファクシミリ装置の疑似中間調画像伝送方法において、原画像の4×4画素の正方領域を一単位として16階調で伝送する場合の手順の一例を示す流れ図、第2図は正方領域の画素パターンによる置き換えを説明する図、第3図は従来のディザ方式の一例を示す流れ図である。

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第1図

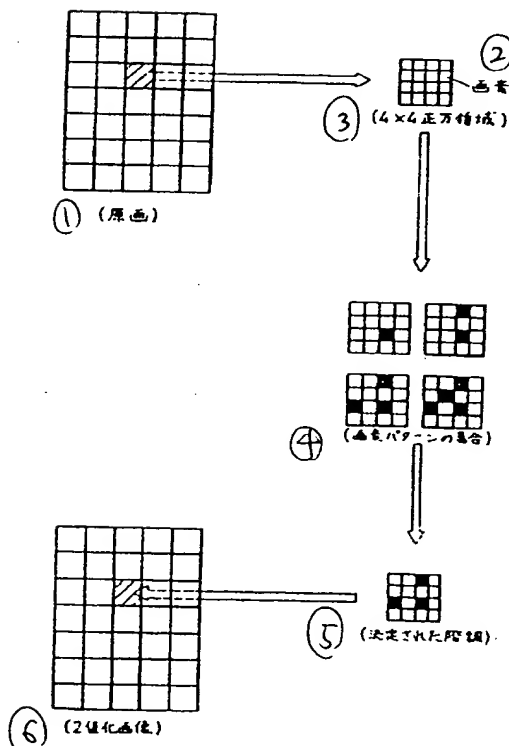
Fig. 1



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第2図

Fig. 2



第3図

Fig. 3

